January 14, 1858.

The LORD WROTTESLEY, President, in the Chair.

The following communications were read :—

I. "On the Electric-Conducting Power of the Metals." By AUGUSTUS MATTHIESSEN, Ph.D. Communicated by C. WHEATSTONE, Esq. Received November 20, 1857.

(Abstract.)

The following values for the conducting power of the metals were determined in the Physical Laboratory at Heidelberg, under the direction of Professor Kirchhoff, by the same method as is described in the 'Philosophical Magazine,' Feb. 1857.

	Conducting Power at Temp. in Celsius's degrees.		
Silver	100°		0°
Copper, No. 3.	77·43		18·8
Copper, No. 2.	72·06		22·6
Gold	55·19		21·8
Sodium	37·43		21·7
Aluminium	33·76		19·6
Copper, No. 1.	30·63		24·2
Zinc	27·39		17·6
Magnesium	25·47		17·0
Calcium	22·14		16·8
Cadmium	22·10		18·8
Potassium	20·85		20·4
Lithium	19·00		20·0
Iron	14·44		20·4
Palladium	12·64		17·2
Tin	11·45		21·0
Platinum	10·53		20·7
Lead	7·77		17·3
Argentine	7·67		18·7
Strontium	6·71		20·0
Antimony	4·29		18·7

	Conducting Power at Temp. in Celsius's degrees.		
Mercury	1·63	.....	22·8
Bismuth	1·19	.....	13·8
Alloy of Bismuth 32 parts, Antimony 1 part	0·884	.....	24·0
Alloy of Bismuth 12 parts, Tin 1 part	0·519	.....	22·0
Alloy of Antimony 2 parts, Zinc 1 part	0·413	.....	25·0
Graphite, No. 1	0·0693	.....	22·0
Graphite, No. 2	0·0436	.....	22·0
Gas-coke	0·0386	.....	25·0
Graphite, No. 3	0·00395	.....	22·0
Bunsen's Battery-Coke	0·00246	.....	26·2
Tellurium	0·000777	.....	19·6
Red Phosphorus	0·00000123	.....	24·0

All the metals were the same as those used for my thermo-electric experiments, with the exception of cadmium, which was purified by my friend Mr. B. Jegel.

The alloys of bismuth-antimony, bismuth-tin, antimony and zinc were determined in order to ascertain whether, as they give, with other metals, such strong thermo-electric currents, they might be more advantageously employed for thermo-electric batteries than those constructed of bismuth and antimony.

Coppers No. 1, 2, 3 were wires of commerce. No. 1 contained small quantities of lead, tin, zinc, and nickel. The low conducting power of No. 1 is owing, as Professor Bunsen thinks, to a small quantity of suboxide being dissolved up in it.

Graphite No. 1 is the so-called pure Ceylon; No. 3 purified German, and No. 2 a mixture of both. The specimens were purified by Brodie's patent and pressed by Mr. Cartmell, to whom I am indebted for the above.

The conducting power for gas-coke, graphite, and Bunsen's battery-coke increases by heat from 0° to 140° C.; it increases for each degree 0·00245, *i. e.* at 0° C. the conducting power = 100, and

between the common temperature and a light red heat about 12 per cent. The following metals were chemically pure :—Silver, gold, zinc, cadmium, tin, lead, antimony, quicksilver, bismuth, tellurium. Those pressed were sodium, zinc, magnesium, calcium, cadmium, potassium, tin, lead, strontium, antimony, bismuth, tellurium, and the alloys of bismuth-antimony and bismuth-tin. The way in which these wires were made is described in the 'Philosophical Magazine' for February 1857.

II. "On the Thermo-electric Series." By AUGUSTUS MATTHIESSEN, Ph.D. Communicated by CHARLES WHEATSTONE, Esq. Received November 20, 1857.

[Abstract.]

Being enabled by the method described in the 'Philosophical Magazine' (Feb. 1857) to obtain wires of the metals of the alkalies and alkaline earths, I have determined their places, together with those of most of the other metals, in the thermo-electric series.

If A, B, C are different metals, and (AB), (BC), (CA) the electromotive powers of thermo-elements formed out of each two of these metals, whose alternate soldering points are at two different temperatures, so is (AB) + (BC) + (CA) = 0, and therefore

$$(AB)=a-b,$$
$$(BC)=b-c,$$
$$(CA)=c-a,$$

where the values a, b, c not only depend on the two temperatures, but also on the nature of each of the metals A, B, C. As the differences of the same constitute the electromotive powers, the value for either of these metals may be put = 0.

If the temperatures of the soldering points of a thermo-element only vary slightly, the electromotive powers may be said to be in ratio with the difference of the two temperatures, and under the same conditions the values a, b, and c are also in ratio with the difference of the temperatures, and their relations to each other therefore independent of the same.